US012227293B2

(12) **United States Patent**
Parker et al.

(10) **Patent No.: US 12,227,293 B2**
(45) **Date of Patent: Feb. 18, 2025**

(54) **ADJUSTABLE FRICTION SLIDER ASSEMBLY FOR PASSENGER SEAT**

(71) Applicant: **Safran Seats USA LLC**, Gainesville, TX (US)

(72) Inventors: **Charles Michael Parker**, Irvine, CA (US); **Foek Nguyen Le**, Arlington, TX (US)

(73) Assignee: **Safran Seats USA LLC**, Gainesville, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 263 days.

(21) Appl. No.: **17/926,003**

(22) PCT Filed: **May 29, 2020**

(86) PCT No.: **PCT/US2020/035348**
§ 371 (c)(1),
(2) Date: **Nov. 17, 2022**

(87) PCT Pub. No.: **WO2021/242261**
PCT Pub. Date: **Dec. 2, 2021**

(65) **Prior Publication Data**

US 2023/0202659 A1 Jun. 29, 2023

(51) **Int. Cl.**
B64D 11/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B64D 11/00152*** (2014.12)

(58) **Field of Classification Search**
CPC B60N 2/826; B60N 2/821; B60N 2/829; B64D 11/0642; B64D 11/00152; B60R 2011/0084
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,039,154 A 3/2000 Moll et al.
7,264,313 B2 * 9/2007 Clough B60N 2/885 297/409

(Continued)

FOREIGN PATENT DOCUMENTS

CN 1180506 A 5/1998
CN 102712448 A 10/2012
CN 107444199 A 12/2017

OTHER PUBLICATIONS

International Patent Application No. PCT/US2020/035348, International Search Report and Written Opinion, dated Mar. 2, 2021.

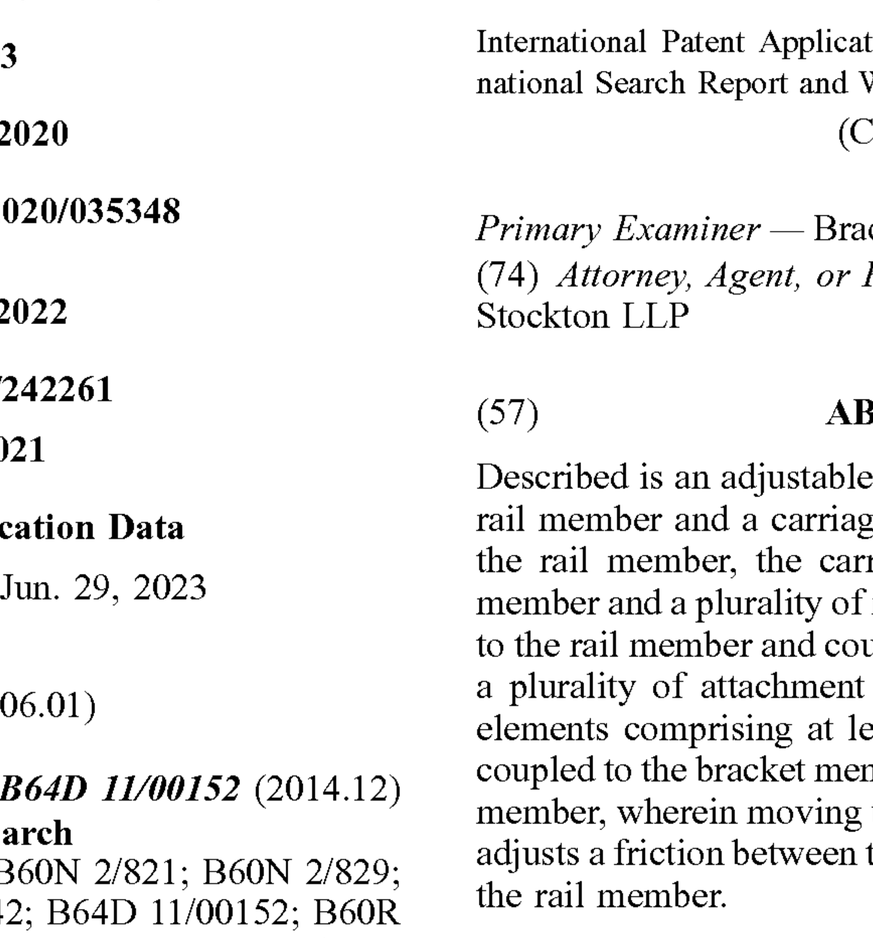
(Continued)

Primary Examiner — Bradley Duckworth
(74) *Attorney, Agent, or Firm* — Kilpatrick Townsend & Stockton LLP

(57) **ABSTRACT**

Described is an adjustable friction slider assembly having a rail member and a carriage assembly moveably coupled to the rail member, the carriage assembly having a bracket member and a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member, wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

20 Claims, 7 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,364,239	B2 *	4/2008	Clough	B60N 2/885 297/391
9,393,892	B1	7/2016	Millan	
10,538,185	B2 *	1/2020	Novin	F16C 29/02
2004/0007910	A1	1/2004	Skelly	
2013/0234490	A1	9/2013	Millan	
2016/0214513	A1	7/2016	Millan	
2018/0105087	A1	4/2018	Novin	

OTHER PUBLICATIONS

Chinese Application No. 202080101490.8, Office Action mailed on Apr. 30, 2024, 8 pages (6 pages of original document and 2 pages of English Translation).

European Application No. 20746420.7, Intention to Grant mailed on Jun. 17, 2024, 8 pages.

Chinese Application No. 202080101490.8, Office Action mailed on Sep. 27, 2024, 6 pages (4 pages of Original Document and 2 pages of English Translation).

* cited by examiner

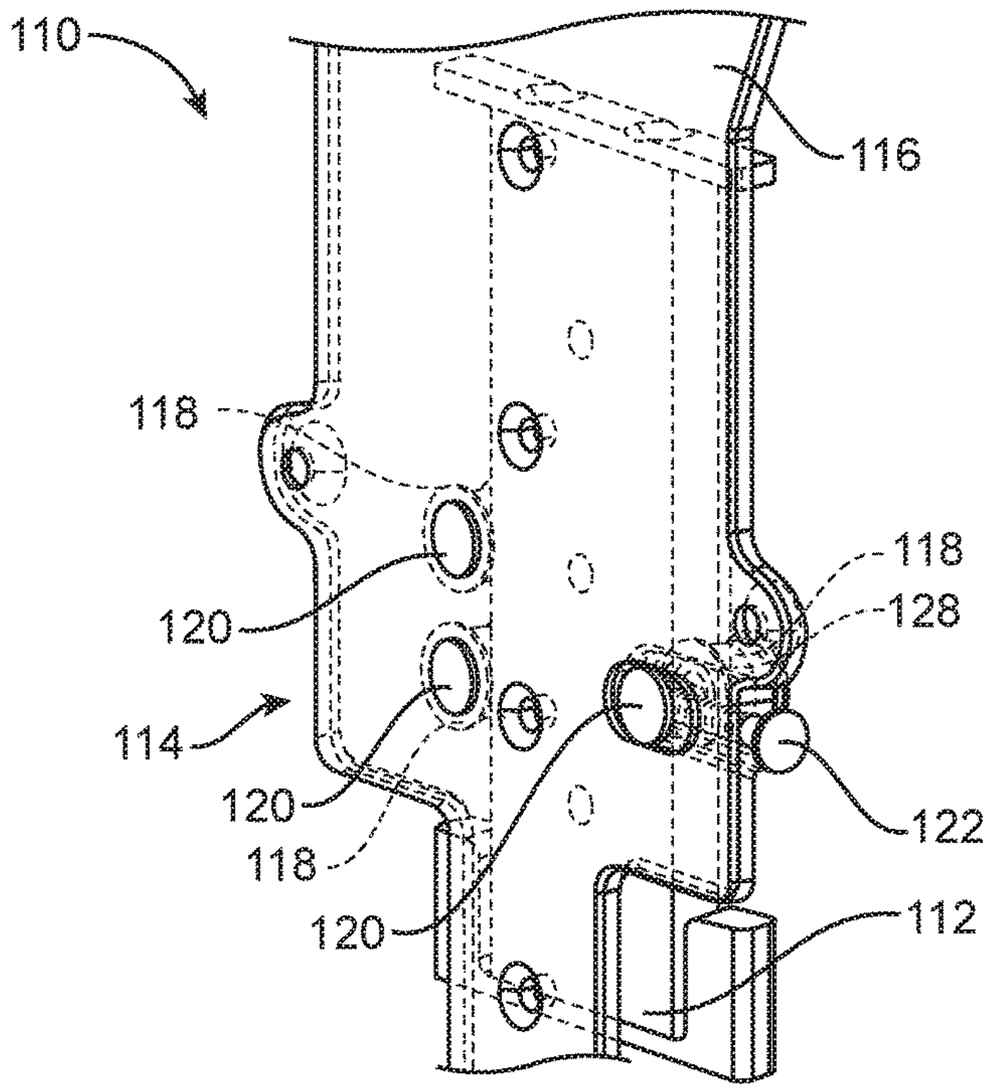

110
116
118
120
114
120
118
120
118
128
122
112

FIG. 1A

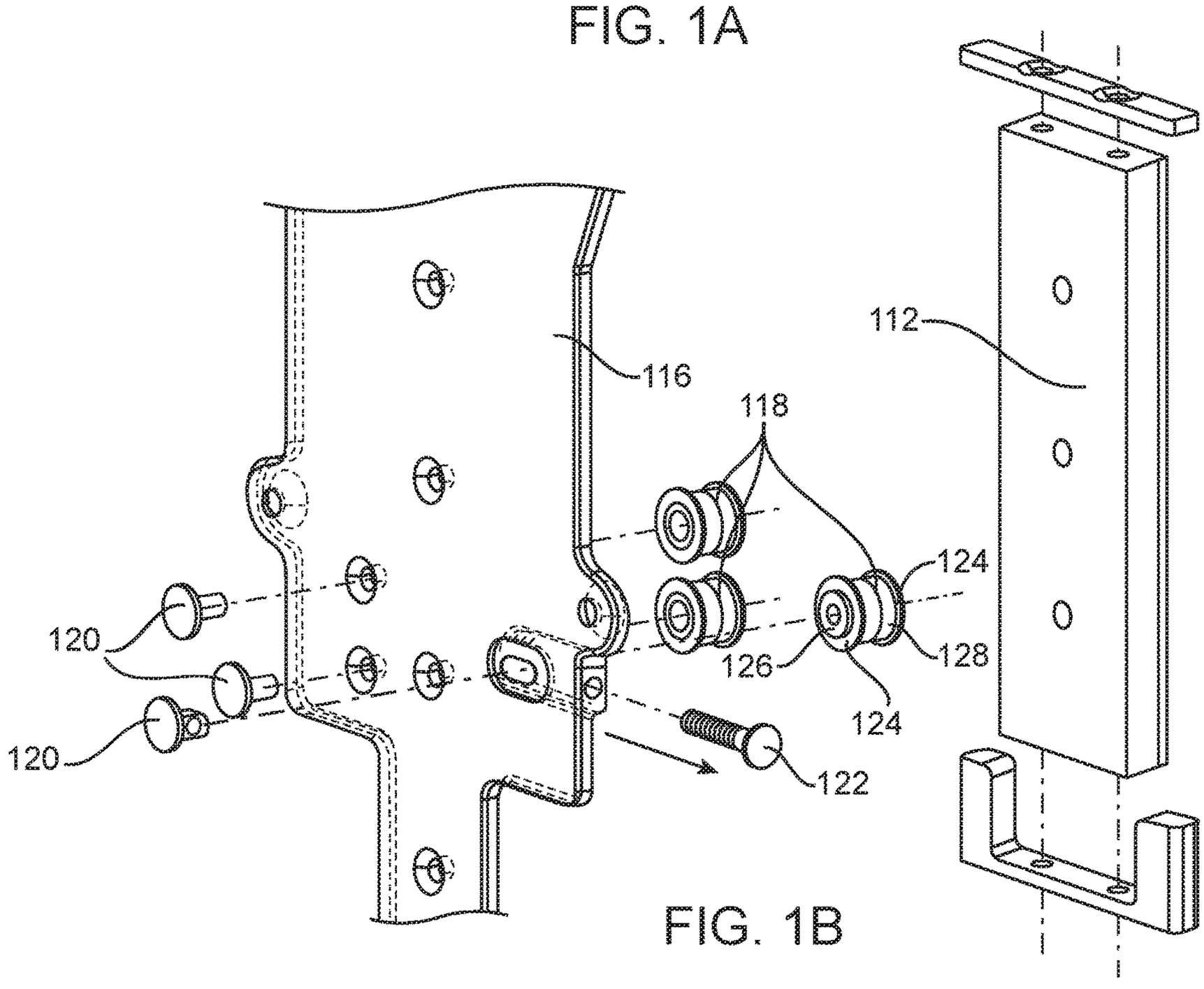

116
118
120
120
120
112
124
126
128
124
122

FIG. 1B

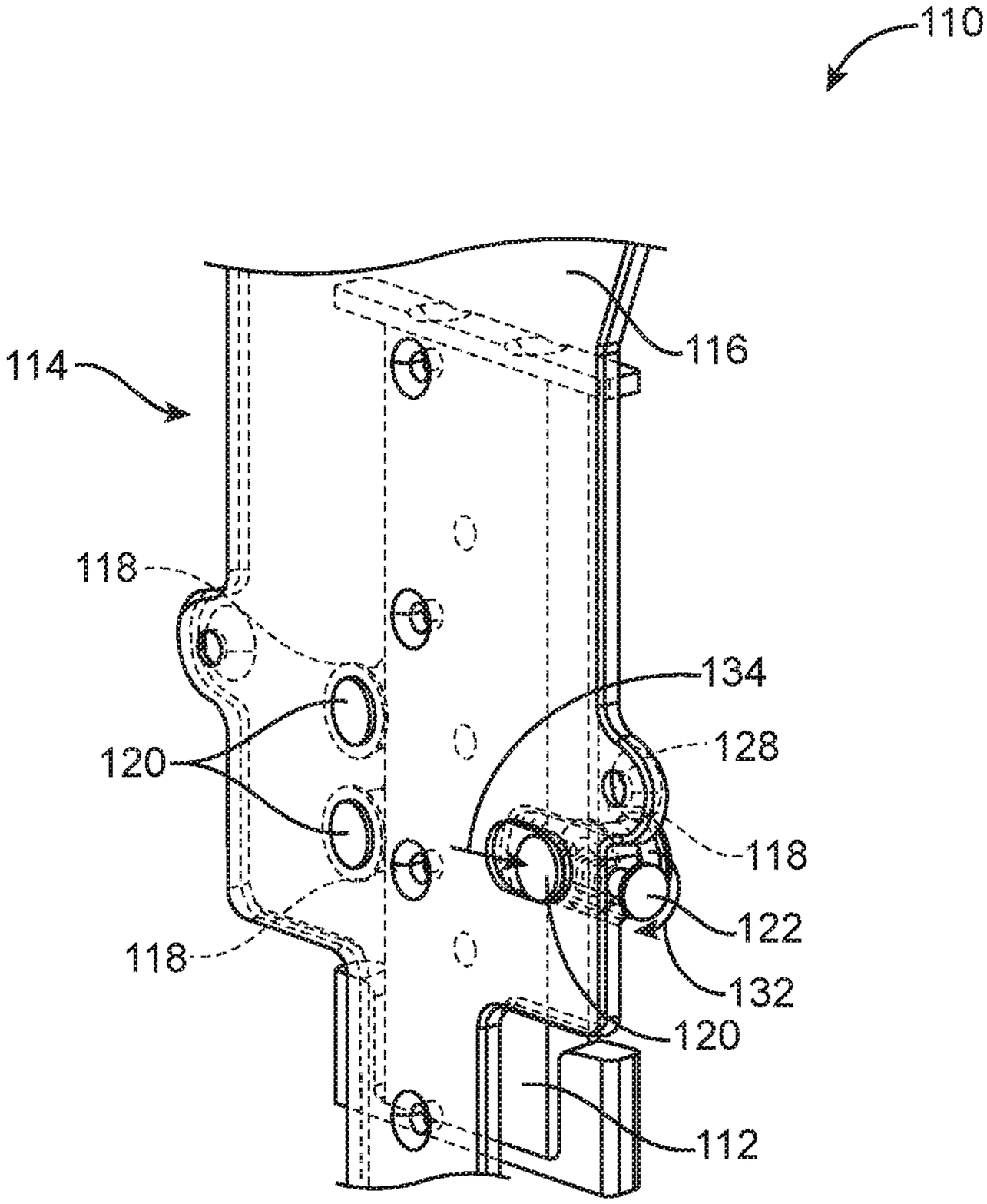


FIG. 1C

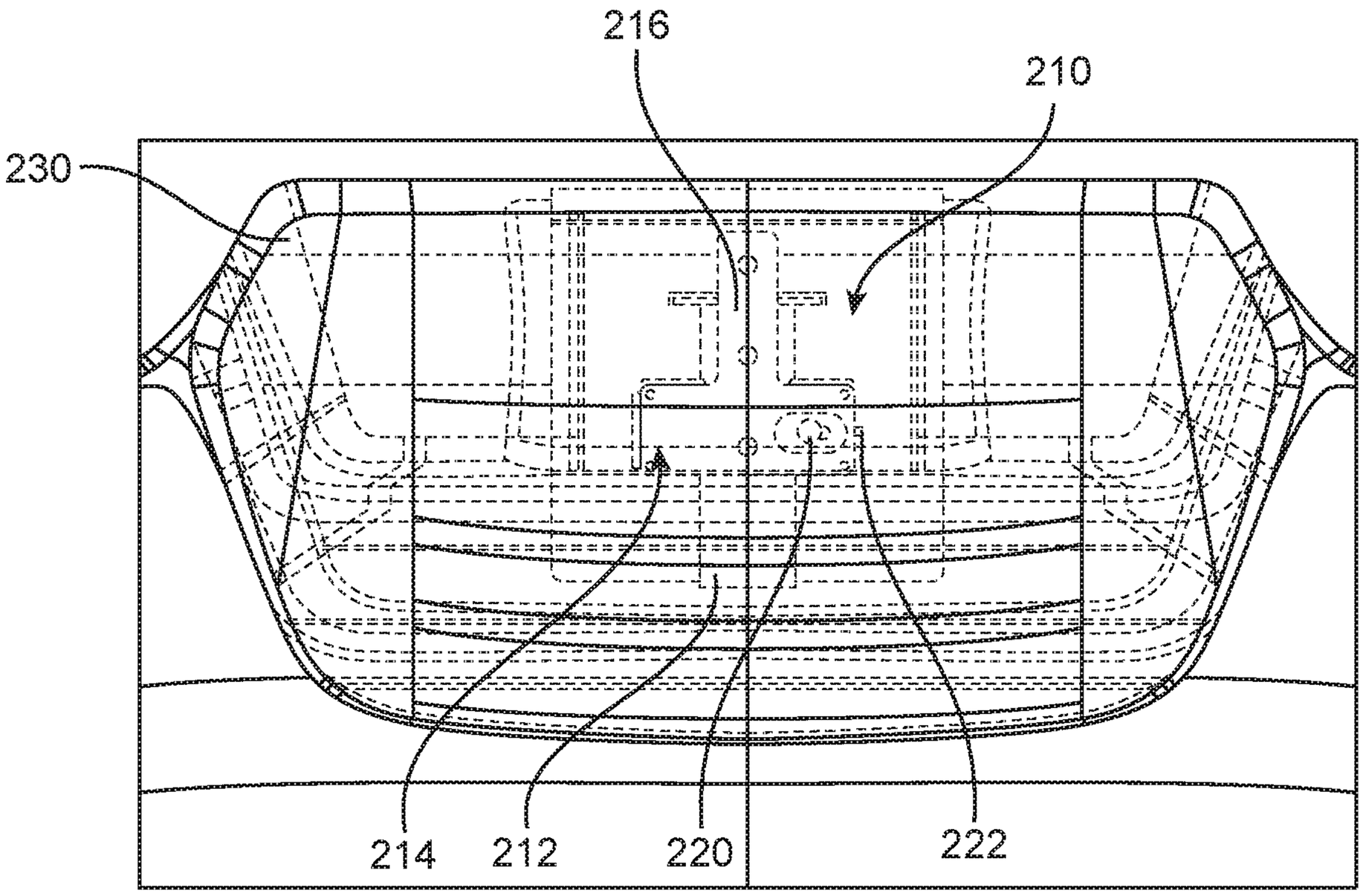


FIG. 2A

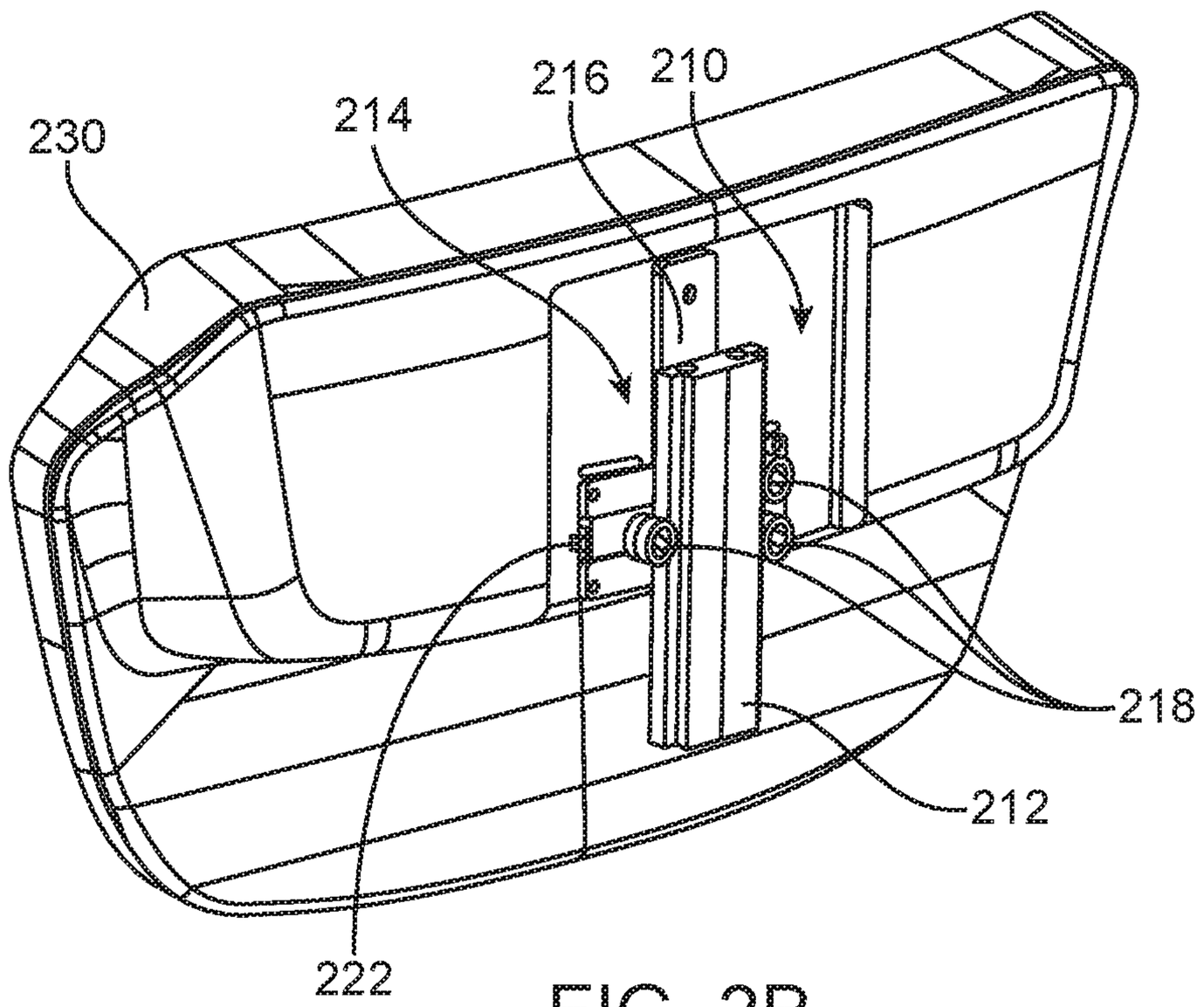


FIG. 2B

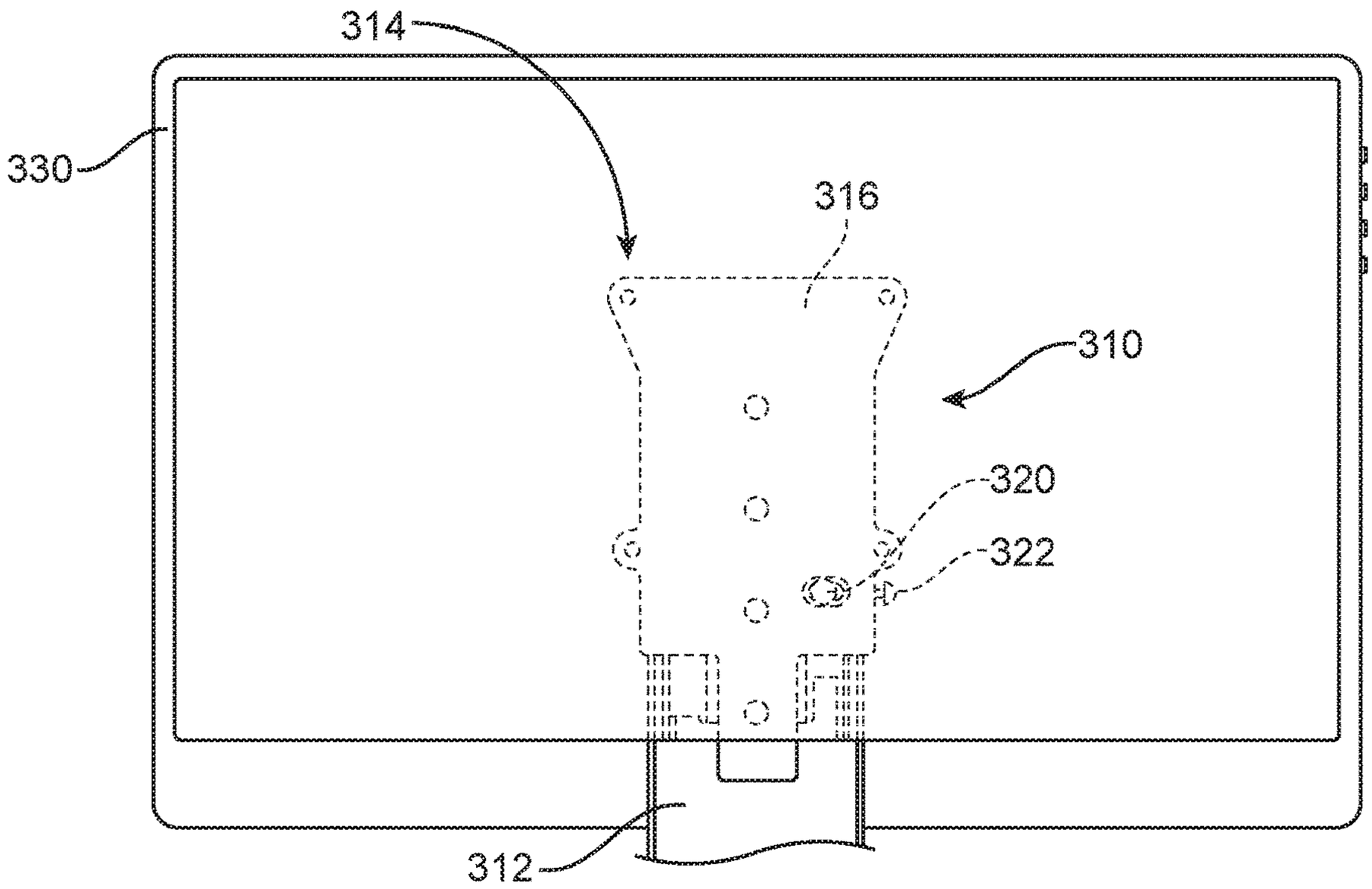


FIG. 3A

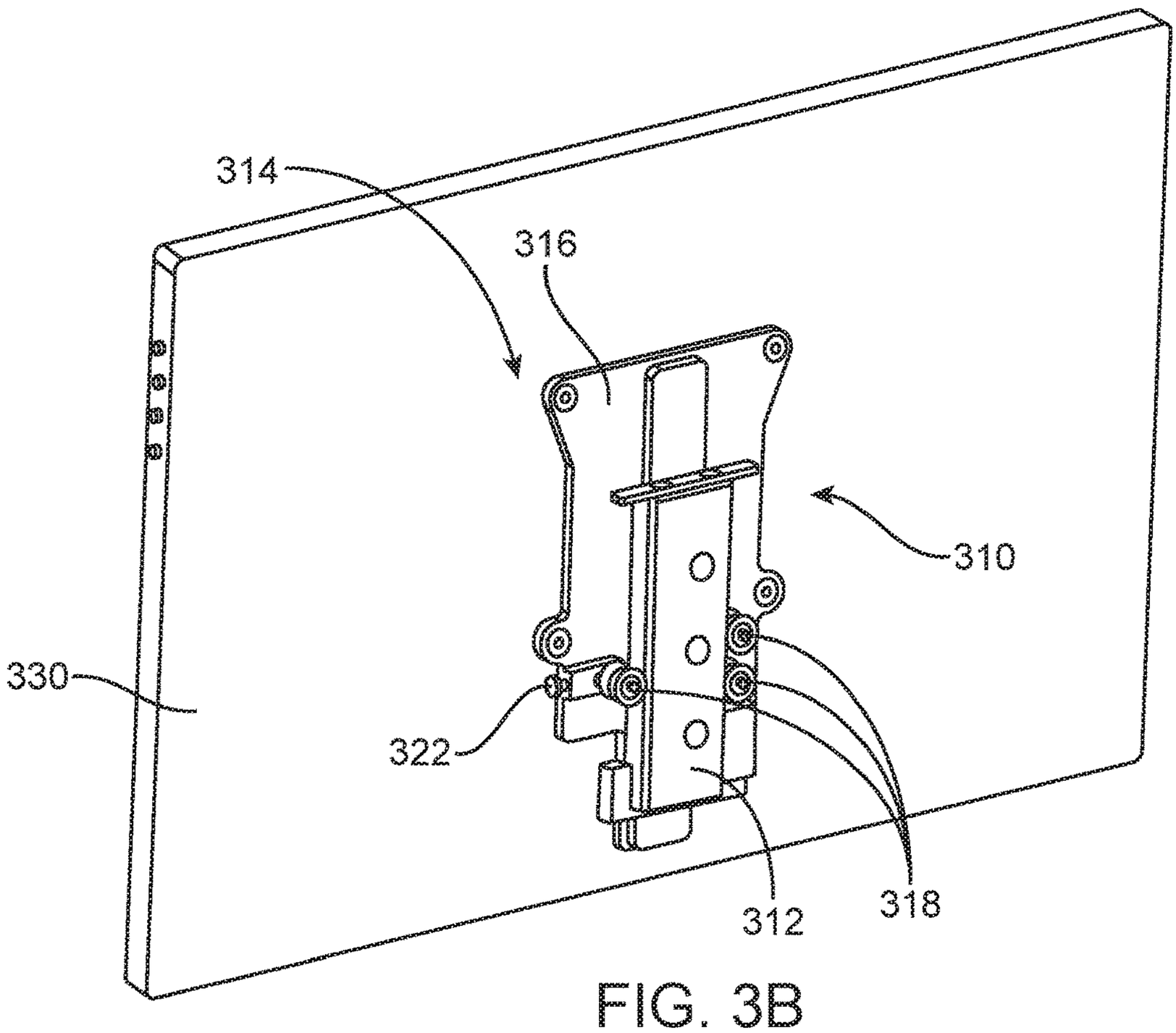


FIG. 3B

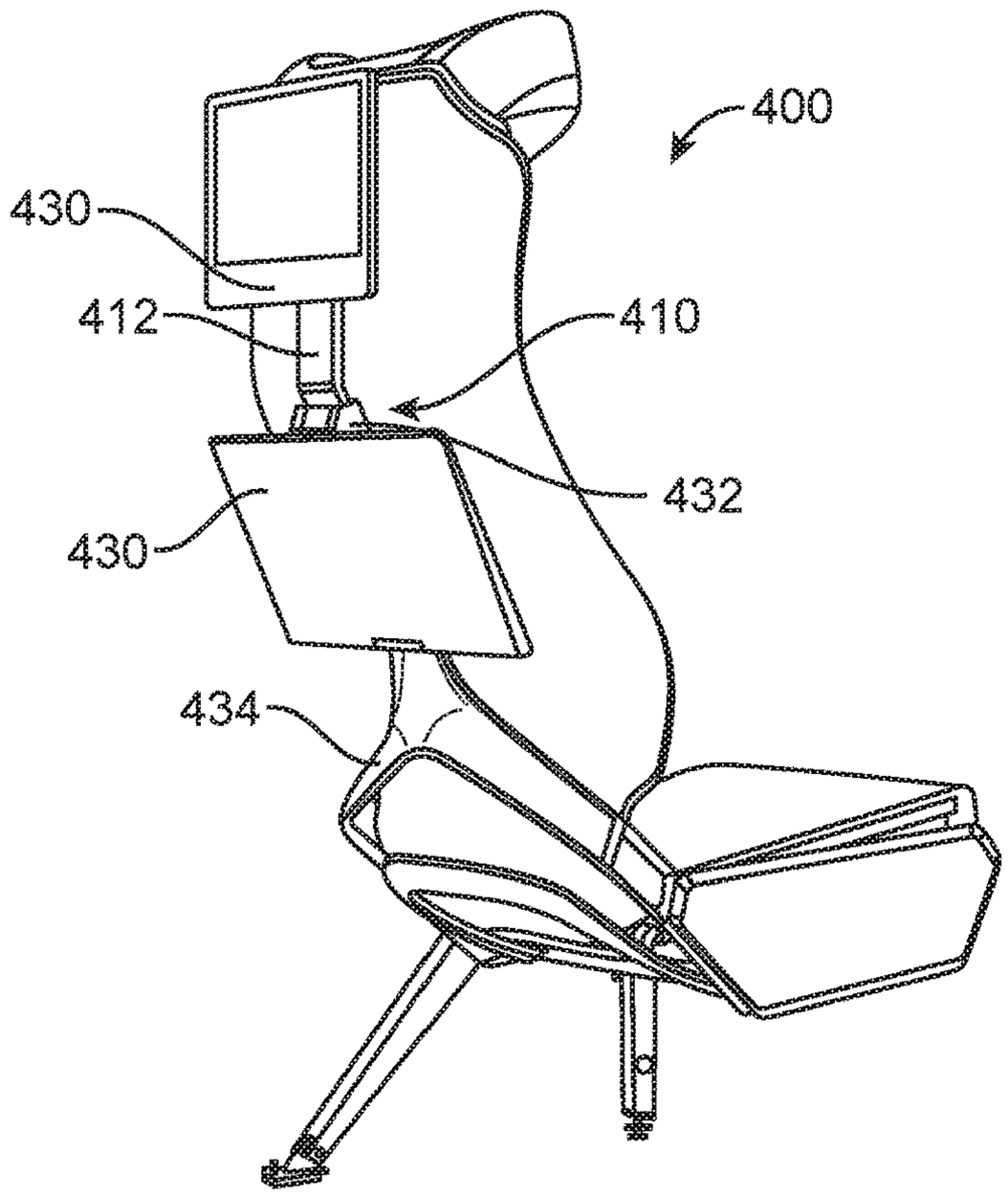


FIG. 4A

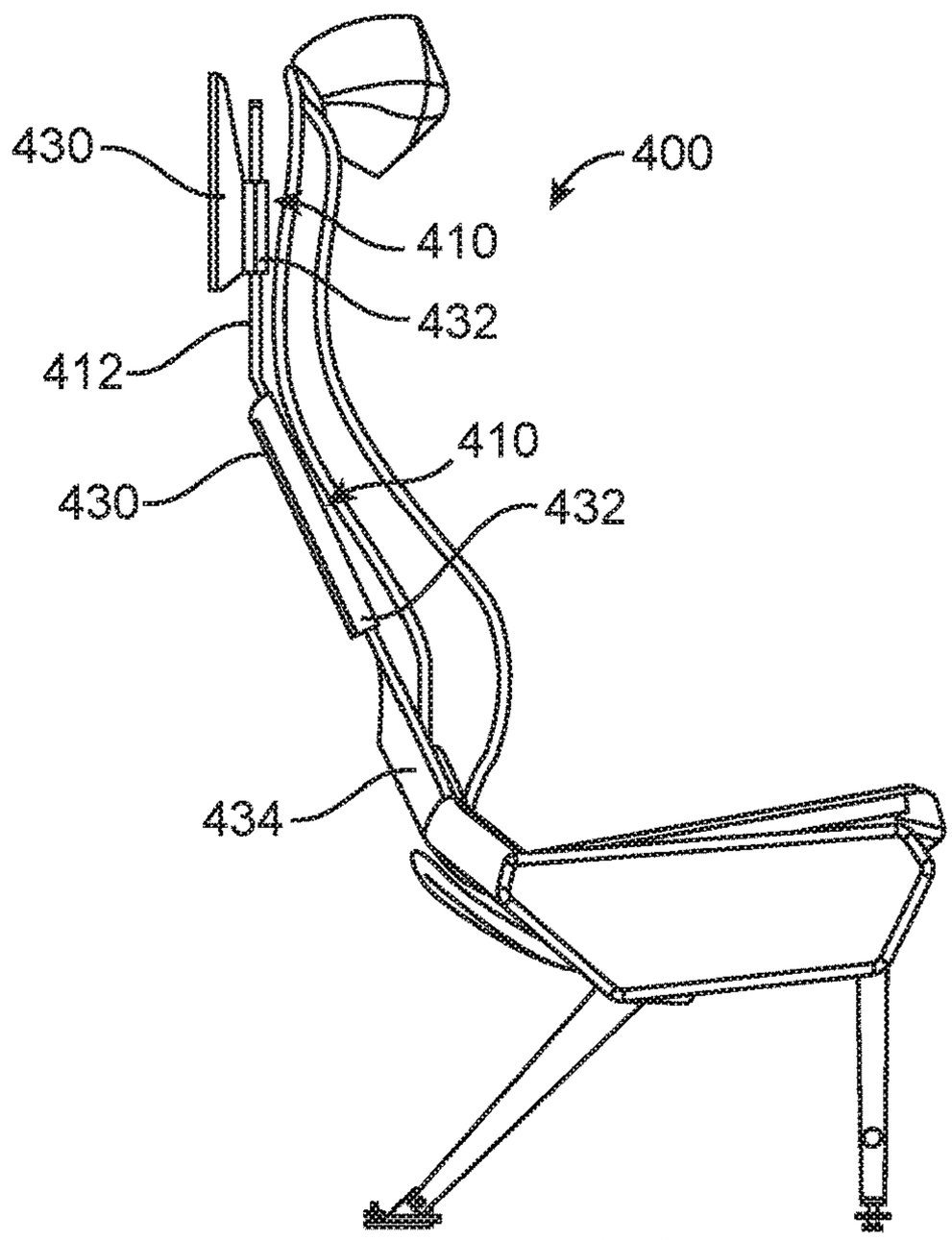


FIG. 4B

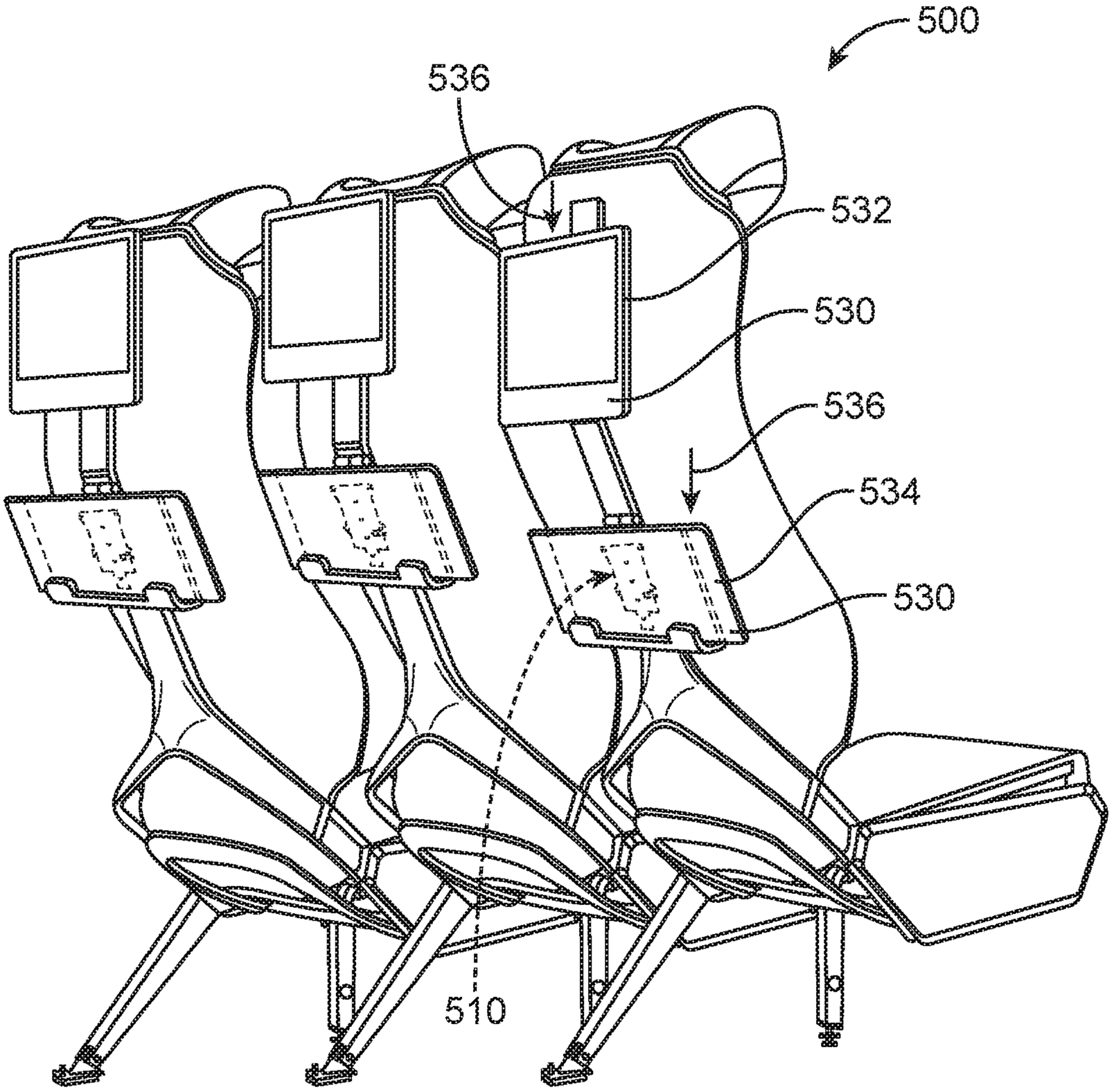


FIG. 5

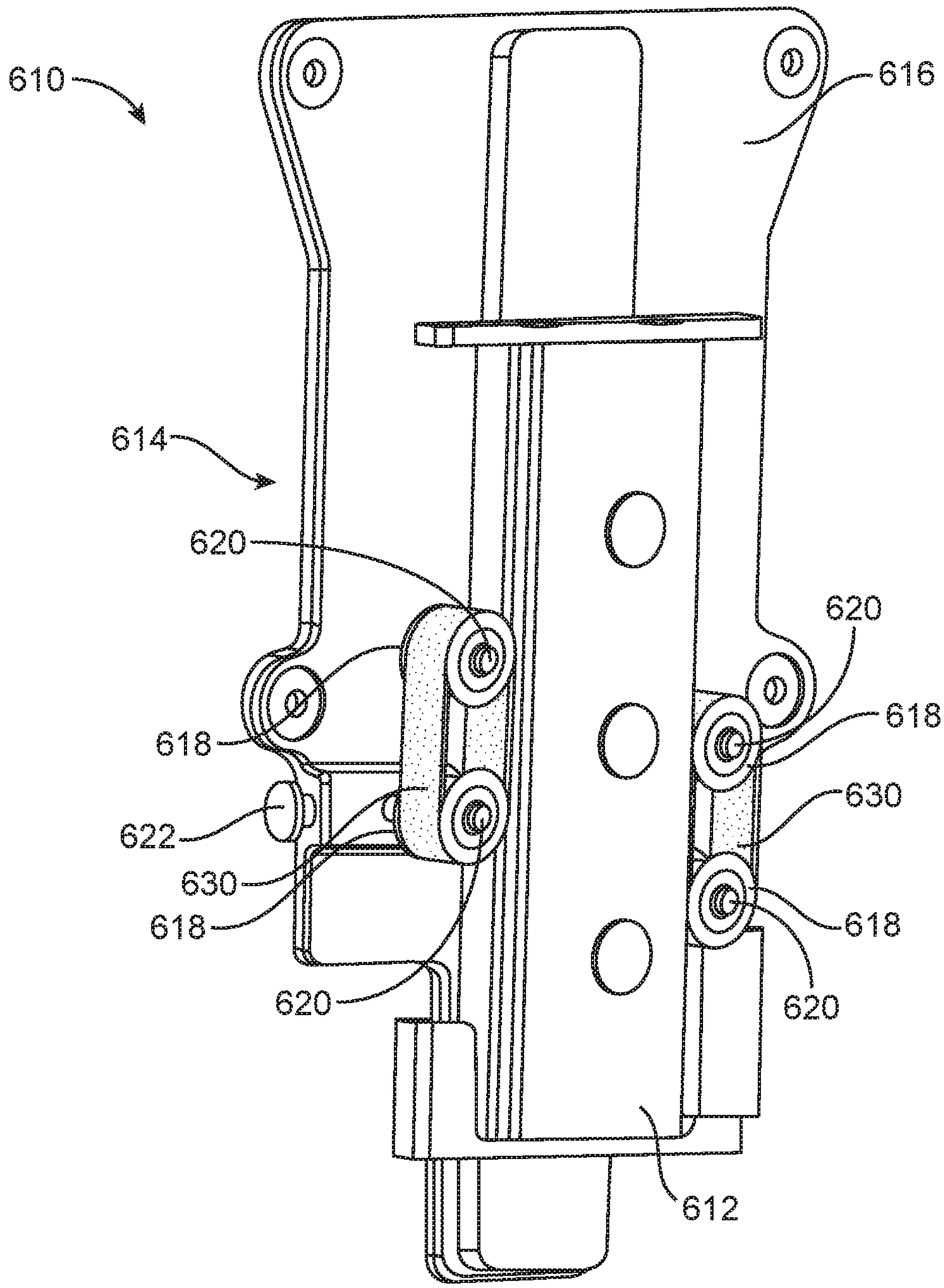


FIG. 6

ADJUSTABLE FRICTION SLIDER ASSEMBLY FOR PASSENGER SEAT

FIELD OF THE INVENTION

The field of the invention relates to a linear sliding mechanism for a passenger seat.

BACKGROUND

Passenger vehicles are incorporating an increasing number of adjustable features into the passenger seats of each passenger vehicle. For example, a passenger seat of an airplane may have sub-assemblies, such as a headrest or an in-flight entertainment system, adjustably attached to the passenger seat so that a passenger may move the headrest and/or the in-flight entertainment system to different suitable heights. Conventional linear sliding systems have been used to enable the movement of these sub-assemblies. However, many sub-assemblies have vastly different sizes and weights so that different individual linear sliding systems are needed to support the different sub-assemblies when they are in a static position. The need for different individual linear sliding systems adds additional costs in the design for manufacturing of precise "interference/friction fit" linear sliding systems that rely critically on tolerance stack-up to maintain performance with minimal maintenance over the lifetime of the linear sliding system.

SUMMARY

The terms "invention," "the invention," "this invention" and "the present invention" used in this patent are intended to refer broadly to all of the subject matter of this patent and the patent claims below. Statements containing these terms should be understood not to limit the subject matter described herein or to limit the meaning or scope of the patent claims below. Embodiments of the invention covered by this patent are defined by the claims below, not this summary. This summary is a high-level overview of various aspects of the invention and introduces some of the concepts that are further described in the Detailed Description section below. This summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used in isolation to determine the scope of the claimed subject matter. The subject matter should be understood by reference to appropriate portions of the entire specification of this patent, any or all drawings and each claim.

According to certain embodiments of the present invention, an adjustable friction slider assembly comprises: a rail member; and a carriage assembly moveably coupled to the rail member, the carriage assembly comprising: a bracket member; and a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member, wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

In some embodiments, the adjustable friction slider assembly further comprises a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

In certain embodiments, the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

The friction may comprise a static friction that causes the carriage assembly to maintain a position along the rail member.

In some embodiments, a moving force that overcomes the static friction is applied to the carriage assembly to move the carriage assembly along the rail member.

The rail member, in certain embodiments, comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

The carriage assembly, in some embodiments, further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

According to certain embodiments of the present invention, a passenger seat comprises an adjustable friction slider assembly comprising: a rail member coupled to the passenger seat; and a carriage assembly moveably coupled to the rail member, the carriage assembly comprising: a bracket member; and a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member, wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

The passenger seat may further comprise a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

In certain embodiments, the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

In some embodiments, the friction comprises a static friction that causes the carriage assembly to maintain a position along the rail member.

A moving force that overcomes the static friction may be applied to the carriage assembly to move the carriage assembly along the rail member.

The rail member, in some embodiments, comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

The carriage assembly, in certain embodiments, further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

According to certain embodiments of the present invention, a method for adjusting a friction of an adjustable friction slider assembly comprises: coupling a carriage assembly to a rail member, the carriage assembly comprising a plurality of roller elements, the plurality of roller elements comprising at least one adjustable roller element; and moving the at least one adjustable roller element relative to the rail member to adjust the friction between the plurality of roller elements and the rail member.

The friction may be adjusted based on a moveable sub-assembly coupled to the carriage assembly.

In certain embodiments, moving the at least one adjustable roller element comprises moving a moveable attach-

ment member, and wherein the moveable attachment member couples the at least one adjustable roller element to the carriage assembly.

In some embodiments, moving the at least one adjustable roller element relative to the rail member comprises moving the at least one adjustable roller element in a direction substantially perpendicular to a longitudinal axis of the rail member.

The method may further comprise applying a moving force to the carriage assembly that overcomes a static friction between the carriage assembly and the rail member to move the carriage assembly along the rail member.

The method, in some embodiments, further comprises: removing the moving force from the carriage assembly; and maintaining the carriage assembly at a location along the rail member where the moving force is removed due to the static friction between the carriage assembly and the rail member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a front perspective view of an adjustable friction slider assembly, according to certain embodiments of the present invention.

FIG. **1**B is an exploded perspective view of the adjustable friction slider assembly of FIG. **1**A.

FIG. **1**C is a front perspective view of the adjustable friction slider assembly of FIG. **1**A with a movement of an adjustable roller element.

FIG. **2**A is a front view of a headrest coupled to an adjustable friction slider assembly, according to certain embodiments of the present invention.

FIG. **2**B is a rear perspective view of the headrest of FIG. **2**A.

FIG. **3**A is a front view of an in-flight entertainment monitor coupled to an adjustable friction slider assembly, according to certain embodiments of the present invention.

FIG. **3**B is a rear perspective view of the in-flight entertainment monitor of FIG. **3**A.

FIG. **4**A is a rear perspective view of a passenger seat incorporating adjustable friction slider assemblies, according to certain embodiments of the present invention.

FIG. **4**B is a right side view of the passenger seat of FIG. **4**A.

FIG. **5** is a rear perspective view of a row of passenger seats incorporating adjustable friction slider assemblies, according to certain embodiments of the present invention.

FIG. **6** is a rear perspective view of an adjustable friction slider assembly incorporating elastic belts, according to certain embodiments of the present invention.

DETAILED DESCRIPTION

The subject matter of embodiments of the present invention is described here with specificity to meet statutory requirements, but this description is not necessarily intended to limit the scope of the claims. The claimed subject matter may be embodied in other ways, may include different elements or steps, and may be used in conjunction with other existing or future technologies. This description should not be interpreted as implying any particular order or arrangement among or between various steps or elements except when the order of individual steps or arrangement of elements is explicitly described.

The described embodiments of the invention provide an adjustable friction slider assembly for passenger seats. While the adjustable friction slider assembly is discussed for use with aircraft seats, it is by no means so limited. Rather, embodiments of the adjustable friction slider assembly may be used in passenger seats or other seats of any type or otherwise as desired.

According to certain embodiments of the present invention, as best shown in FIGS. **1**A-**1**C, an adjustable friction slider assembly **110** comprises a rail member **112** and a carriage assembly **114**. The carriage assembly **114** comprises a bracket member **116** and at least one roller element **118**. In some embodiments, the carriage assembly **114** may comprise at least one attachment member **120** and/or a friction adjustment member **122**.

The adjustable friction slider assembly **110** and any component of the adjustable friction slider assembly **110** (e.g., the rail member **112**, the carriage assembly **114**, the bracket member **116**, the at least one roller element **118**, the at least one attachment member **120**, or the friction adjustment member **122**) may be formed of materials including but not limited to aluminum, stainless steel, aramid fibers, polycarbonate, polypropylene, other metallic materials, composite materials, or other similar materials. Due to the nature of the repetitive use of the adjustable friction slider assembly **110**, the material(s) used to form the various components of the adjustable friction slider assembly **110** may be selected based on the wear resistance of the material(s). Additionally, each of the components of the adjustable friction slider assembly **110** may be formed of the same material, different materials, or any combination of the same or different materials.

The various components of the adjustable friction slider assembly **110** may each be any suitable shape. For example, the bracket member **116** may be circular, triangular, rectangular, square-shaped, oval-shaped, etc. The rail member **112** may be any suitable length and depth and may have any suitable cross-section, such as a rectangular cross-section, a square cross-section, a circular cross-section, an oval cross-section, a curved cross-section, a parabolic cross-section, etc.

In some embodiments, the carriage assembly **114** is moveably coupled to the rail member **112** so that the carriage assembly **114** may move along the length or longitudinal axis of the rail member **112**. The at least one roller element **118** may be coupled to the bracket member **116** so that the at least one roller element **118** moveably couples the carriage assembly **114** to the rail member **112**. The at least one roller element **118** may be a bearing, e.g., a roller bearing, circulating bearing wheel, etc., or any other suitable device having a low dynamic friction and a high static friction. Additionally, the at least one roller element **118** may include at least one flanged edge **124** that may assist with keeping the carriage assembly **114** coupled to the rail member **112**. The at least one flanged edge **124** of the at least one roller element **118** may form a groove that enables the at least one roller element **118** to capture the rail member **112**. In fact, the at least one roller element **118** may have any suitable cross-section that enables the at least one roller element **118** to be coupled with and securely capture the rail member **112**.

The at least one roller element **118** may be coupled to the bracket member **116** of the carriage assembly **114**. For example, at least one attachment member **120** may extend through at least one opening in the bracket member **116** and through at least one opening in each of the at least one roller elements **118** to attach each of the at least one roller elements **118** to the carriage assembly **114**. The at least one attachment member **120** may be any suitable device for securing the at least one roller element **118** to the bracket member **116**, e.g., a pin, a screw, a bolt, a nail, etc. Additionally, the at least one roller element **118** may include a spacer member **126**

extending through the at least one roller element **118**. The at least one attachment member **120** may extend through the spacer member **126**. The spacer member **126** may then assist with securing the at least one roller element **118** to the at least one attachment member **120** while permitting the at least one roller element **118** to freely rotate relative to the at least one attachment member **120**.

The carriage assembly **114** may include any suitable number of roller elements **118**, e.g., one, two, three, four, five, six, seven, etc. In some embodiments, the number of attachment members **120** and spacer members **126** corresponds to the number of roller elements **118**. Having at least three roller elements **118** as part of the carriage assembly **114** may restrict the number of degrees of freedom of the carriage assembly **114** to a single degree of freedom and thus fully constrain the carriage assembly **114**. The single degree of freedom of the carriage assembly **114** may permit movement of the carriage assembly **114** along the longitudinal axis of the rail member **112**.

In some embodiments, at least one of the roller elements **118** is an adjustable roller element **128**. The adjustable roller element **128** may be coupled with the bracket member **116** using a moveable attachment member **120** so that the adjustable roller element **128** is moveable relative to the carriage assembly **114** and the rail member **112**. For example, the adjustable roller element **128** may move in a direction substantially perpendicular to the longitudinal axis of the rail member **112**.

Moving the adjustable roller element **128** may adjust the amount of friction between the roller elements **118** and the rail member **112**. Moving the adjustable roller element **128** towards or away from the rail member **112** changes the amount of force applied to the rail member **112** by the adjustable roller element **128** and, as a result, any of the non-adjustable roller elements **118** that are part of the carriage assembly **114** as well. For example, moving the adjustable roller element **128** towards the rail member **112** increases the amount of force applied to the rail member **112** by the adjustable roller element **128** and the non-adjustable roller elements **118**. Thus the friction, and more specifically the static friction, between the rail member **112** and the carriage assembly **114** increases.

In some embodiments, as best illustrated in FIG. **1**C, the adjustable roller element **128** may be moved using the friction adjustment member **122**. In some embodiments, the friction adjustment member **122** and the attachment member **120** extending through the adjustable roller element **128** may be a singular element or separate elements. For example, the friction adjustment member **122** may be a threaded pin, screw, compounding springs, a spring force actuator, any combination of these devices, or any other similar device that is coupled with the attachment member **120**. Thus the amount of friction between the adjustable roller element **128**, the roller elements **118**, and the rail member **112** may be controlled by moving the friction adjustment member **122**. For example, the friction adjustment member **122** may be rotated, as represented by arrow **132**, which causes the adjustable roller element **128** to move towards or away from the rail member **112** and to adjust the friction between the carriage assembly **114** and the rail member **112**. Arrow **134** represents movement of the attachment member **120** and the adjustable roller element **128** away from the rail member **112** due to the rotation of the friction adjustment member **122**.

It should be understood that any number of the roller elements **118** may be an adjustable roller element **128**. In fact, all of the roller elements **118** of the carriage assembly **114** may be adjustable roller elements **128**. Increasing the number of adjustable roller elements **128** incorporated into the carriage assembly **114** may enable more fine-tuned and uniform adjustments of the friction between the carriage assembly **114** and the rail member **112**.

According to certain embodiments of the present invention, as best shown in FIGS. **2**A-**2**B, an adjustable friction slider assembly **210** may be used to couple a sub-assembly **230** to a passenger seat. The adjustable friction slider assembly **210** may be the same or similar to the adjustable friction slider assembly **110** described above in reference to FIGS. **1**A-**1**C. For example, the adjustable friction slider assembly **210** may comprise a rail member **212** and a carriage assembly **214** where the carriage assembly **214** may comprise a bracket member **216**, at least one roller element **218**, at least one attachment member **220**, and/or a friction adjustment member **222**. The various components of the adjustable friction slider assembly **210** may include any of the features described above in relation to FIGS. **1**A-**1**C.

In some embodiments, the sub-assembly **230** may be a headrest, an in-flight entertainment or video monitor, a tray table, a portable electronic device holder, etc. The sub-assembly **230** is a headrest. The sub-assembly **230** may be coupled to the adjustable friction slider assembly **210**. For example the sub-assembly **230** may be coupled to the bracket member **216** using any suitable form of chemical or mechanical attachment including, but not limited to, nuts and bolts, screws, pins and rivets, a snap-fit connection, a friction fit connection, adhesive, welding, other mechanical fasteners, and/or other chemical fasteners.

The sub-assembly **230** may be coupled directly or indirectly to the bracket member **216**. In some embodiments, the sub-assembly **230** may be coupled to an intermediate member that is then attached to the bracket member **216**. The intermediate member may assist with restricting any movement of the sub-assembly **230** relative to the bracket member **216** or the intermediate member may permit pivoting of the sub-assembly **230** relative to the bracket member **216**. Permitting pivoting of the sub-assembly **230** relative to the bracket member **216** may enable a passenger to adjust the angle of the sub-assembly **230**.

According to certain embodiments of the present invention, as best shown in FIGS. **3**A-**3**B, an adjustable friction slider assembly **310** may be used to couple a sub-assembly **330** to a passenger seat. The sub-assembly **330** shown is an in-flight entertainment monitor. The adjustable friction slider assembly **310** may be the same or similar to the adjustable friction slider assembly **110**, **210** described above in reference to FIGS. **1**A-**2**B. For example, the adjustable friction slider assembly **310** may comprise a rail member **312** and a carriage assembly **314** where the carriage assembly **314** may comprise a bracket member **316**, at least one roller element **318**, at least one attachment member **320**, and/or a friction adjustment member **322**. The various components of the adjustable friction slider assembly **310** may include any of the features described above in relation to FIGS. **1**A-**2**B.

According to certain embodiments of the present invention, as best shown in FIGS. **4**A-**4**B, an adjustable friction slider assembly **410** may be used to couple a sub-assembly **430** to a passenger seat **400**. The adjustable friction slider assembly **410** may be the same or similar to the adjustable friction slider assembly **110**, **210**, **310** described above in reference to FIGS. **1**A-**3**B and the sub-assembly **430** may be the same or similar to the sub-assembly **230**, **330** described above in reference to FIGS. **2**A-**3**B. For example, the adjustable friction slider assembly **410** may comprise a rail

member **412** and a carriage assembly where the carriage assembly may comprise a bracket member, at least one roller element, at least one attachment member, and/or a friction adjustment member. The various components of the adjustable friction slider assembly **410** may include any of the features described above in relation to FIGS. **1**A-**3**B.

In some embodiments, the adjustable friction slider assembly **410** may be housed in an outer casing **432** that at least partially or wholly encloses the adjustable friction slider assembly **410**. The outer casing **432** may protect the adjustable friction slider assembly **410** from damage and prevent tampering with the adjustable friction slider assembly **410**. The outer casing **432** may also provide a more seamless and finished aesthetic to the adjustable friction slider assembly **410**. Additionally, the rail member **412** may be part of or integrally formed with a seat back shroud **434** or the rail member **412** may be a discrete element that extends at least partially into a seat back or other portion of a passenger seat **400**.

According to certain embodiments of the present invention, as best shown in FIG. **5**, an adjustable friction slider assembly **510** may be used to couple a sub-assembly **530** to a passenger seat **500**. The adjustable friction slider assembly **510** may be the same or similar to the adjustable friction slider assembly **110**, **210**, **310**, **410** described above in reference to FIGS. **1**A-**4**B and the sub-assembly **530** may be the same or similar to the sub-assembly **230**, **330**, **430** described above in reference to FIGS. **2**A-**4**B. For example, the adjustable friction slider assembly **510** may comprise a rail member and a carriage assembly where the carriage assembly may comprise a bracket member, at least one roller element, at least one attachment member, and/or a friction adjustment member. The various components of the adjustable friction slider assembly **510** may include any of the features described above in relation to FIGS. **1**A-**4**B.

The same adjustable friction slider assembly **510** may be used regardless of the type of sub-assembly **530** being used. For example, the same adjustable friction slider assembly **510** may be used to attach both the in-flight entertainment monitor **532** and the personal electronic device holder **534** to the passenger seat **500** because of the adjustability of the friction of the adjustable friction slider assembly **510**.

As described above in reference to FIGS. **1**A-**1**C, the carriage assembly of each adjustable friction slider assembly **510** is coupled to the rail member and the adjustable roller element is moved towards or away from the rail member to adjust the amount of force the carriage assembly applies against the rail member. The adjustable friction slider assembly **510** used to attach the in-flight entertainment monitor **532** and the adjustable friction slider assembly **510** used to attach the personal electronic device holder **534** may each be adjusted to create different amounts of friction in the respective adjustable friction slider assembly **510**.

The adjustment of the adjustable roller element may be based on the amount of force necessary to create sufficient static friction to hold the adjustable friction slider assembly **510** in a stationary position supporting the sub-assembly **530** while having a relatively low dynamic friction that permits a smooth movement of the adjustable friction slider assembly **510** along the rail member. The amount of friction necessary for an in-flight entertainment monitor versus a personal electronic device holder or any other sub-assembly will be different and will largely depend on the size and weight of the sub-assembly **530**. In some embodiments, the manufacturer or installer of the passenger seat **500** may move the adjustable roller element of each adjustable friction slider assembly **510** to create the necessary amount of friction for the respective sub-assembly **530** that each adjustable friction slider assembly **510** supports.

In some embodiments, the carriage assembly may be permitted to slide along the rail member after the friction is set by the adjustable roller element. For example, a downward force, represented by arrows **536**, may be applied to each sub-assembly **530**. When the downward force is enough to overcome the static friction of the respective adjustable friction slider assemblies **510**, the dynamic friction between the carriage assembly and the rail member permits a smooth movement of the carriage assembly along the rail member. It should be understood that an upward force may also be applied to each sub-assembly **530** to cause the sub-assemblies **530** to move.

After the downward force is removed, the static friction between the carriage assembly and the rail member once again causes the adjustable friction slider assembly **510** to maintain a stationary position. So a user may adjust a position of the sub-assembly **530** relative to the rail member by applying a force to the sub-assembly **530** or in some cases by applying a force directly to the adjustable friction slider assembly **510**. Once the sub-assembly **530** is at the new location, the user may stop applying the force. The sub-assembly **530** will then remain at the new location due to the static friction created by the adjustable friction slider assembly **510**.

Using the adjustable friction slider assembly **510** may reduce the cost of manufacturing the passenger seat **500** and increase the interchangeability of the various types of sub-assemblies due to the need for only a single design of the adjustable friction slider assembly **510** regardless of the type of sub-assembly used. This may lead to easier customization of the passenger seats **500** because the sub-assemblies may be removed and replaced without the need to replace the adjustable friction slider assembly **510**.

According to certain embodiments of the present invention, as best shown in FIG. **6**, an adjustable friction slider assembly **610** may incorporate at least one elastic band **630**. The adjustable friction slider assembly **610** may be the same or similar to the adjustable friction slider assembly **110**, **210**, **310**, **410**, **510** described above in reference to FIGS. **1**A-**5**. For example, the adjustable friction slider assembly **610** may comprise a rail member **612** and a carriage assembly **614** where the carriage assembly **614** may comprise a bracket member **616**, at least one roller element **618**, at least one attachment member **620**, and/or a friction adjustment member **622**. The various components of the adjustable friction slider assembly **610** may include any of the features described above in relation to FIGS. **1**A-**1**C.

In some embodiments, the at least one elastic band **630** may be positioned around the at least one roller element **618**. Positioning the at least one elastic band **630** around the at least one roller element **618** may increase the static friction as well as the dynamic friction of the adjustable friction slider assembly **610**. The at least one elastic band **630** may be positioned around the at least one roller element **618** so that at least one portion of the at least one elastic band **630** is positioned at least partially between the at least one roller element **618** and the rail member **612**. As the carriage assembly **614** moves along the rail member **612**, the at least one elastic band **630** moves with the at least one roller element **618**.

The adjustable friction slider assembly **610** may include a plurality of roller elements **618** positioned on multiple sides of the rail member **612**. An elastic band **630** may be positioned around each set of roller elements **618** arranged linearly in the longitudinal direction of the rail member **612**.

For example, two roller elements **618** may be linearly aligned on a left side of the rail member **612** and two separate roller elements **618** may be linearly aligned on a right side of the rail member **612**. One elastic band **630** may be positioned around each set of roller elements **618** so that at least a portion of each elastic band **630** is positioned between each respective roller element **618** and the rail member **612**.

Positioning the at least one portion of the at least one elastic band **630** between the at least one roller element **618** and the rail member **612** may help to dampen any sound created as the at least one roller element **618** moves along the rail member **612**, may assist in maintaining constant friction, and thus minimizing slippage, between the carriage assembly **614** and the rail member **612**, and may minimize wear on the at least one roller element **618** and the rail member **612**.

Elements of any of the embodiments discussed above may be fully interchangeable with one another. In the following, further examples are described to facilitate the understanding of the invention (and in some aspects, features of an apparatus or system described in one or more of these examples can be utilized in a method described in one of the other examples or vice versa):

Example 1. An adjustable friction slider assembly (which may incorporate features of any of the subsequent examples) comprising: a rail member; and a carriage assembly moveably coupled to the rail member, the carriage assembly comprising: a bracket member; and a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member, wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

Example 2. The adjustable friction slider assembly of Example 1 or any of the preceding or subsequent examples, further comprising a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

Example 3. The adjustable friction slider assembly of Example 2 or any of the preceding or subsequent examples, wherein the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

Example 4. The adjustable friction slider assembly of Example 1 or any of the preceding or subsequent examples, wherein the friction comprises a static friction that causes the carriage assembly to maintain a position along the rail member.

Example 5. The adjustable friction slider assembly of Example 4 or any of the preceding or subsequent examples, wherein a moving force that overcomes the static friction is applied to the carriage assembly to move the carriage assembly along the rail member.

Example 6. The adjustable friction slider assembly of Example 1 or any of the preceding or subsequent examples, wherein the rail member comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

Example 7. The adjustable friction slider assembly of Example 1 or any of the preceding or subsequent examples, wherein the carriage assembly further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

Example 8. A passenger seat (which may incorporate features of any of the preceding or subsequent examples) comprising an adjustable friction slider assembly comprising: a rail member coupled to the passenger seat; and a carriage assembly moveably coupled to the rail member, the carriage assembly comprising: a bracket member; and a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member, wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

Example 9. The passenger seat of Example 8 or any of the preceding or subsequent examples, further comprising a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

Example 10. The passenger seat of Example 9 or any of the preceding or subsequent examples, wherein the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

Example 11. The passenger seat of Example 8 or any of the preceding or subsequent examples, wherein the friction comprises a static friction that causes the carriage assembly to maintain a position along the rail member.

Example 12. The passenger seat of Example 11 or any of the preceding or subsequent examples, wherein a moving force that overcomes the static friction is applied to the carriage assembly to move the carriage assembly along the rail member.

Example 13. The passenger seat of Example 8 or any of the preceding or subsequent examples, wherein the rail member comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

Example 14. The passenger seat of Example 8 or any of the preceding or subsequent examples, wherein the carriage assembly further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

Example 15. A method (which may incorporate features of any of the preceding or subsequent examples) for adjusting a friction of an adjustable friction slider assembly comprising: coupling a carriage assembly to a rail member, the carriage assembly comprising a plurality of roller elements, the plurality of roller elements comprising at least one adjustable roller element; and moving the at least one adjustable roller element relative to the rail member to adjust the friction between the plurality of roller elements and the rail member.

Example 16. The method of Example 15 or any of the preceding or subsequent examples, wherein the friction is adjusted based on a moveable sub-assembly coupled to the carriage assembly.

Example 17. The method of Example 15 or any of the preceding or subsequent examples, wherein moving the at least one adjustable roller element comprises moving a moveable attachment member, and wherein the moveable attachment member couples the at least one adjustable roller element to the carriage assembly.

Example 18. The method of Example 15 or any of the preceding or subsequent examples, wherein moving the at least one adjustable roller element relative to the rail member comprises moving the at least one adjustable roller element in a direction substantially perpendicular to a longitudinal axis of the rail member.

Example 19. The method of Example 15 or any of the preceding or subsequent examples, further comprising applying a moving force to the carriage assembly that overcomes a static friction between the carriage assembly and the rail member to move the carriage assembly along the rail member.

Example 20. The method of Example 19 or any of the preceding examples, further comprising: removing the moving force from the carriage assembly; and maintaining the carriage assembly at a location along the rail member where the moving force is removed due to the static friction between the carriage assembly and the rail member.

Different arrangements of the components depicted in the drawings or described above, as well as components and steps not shown or described are possible. Similarly, some features and sub-combinations are useful and may be employed without reference to other features and sub-combinations. Embodiments of the invention have been described for illustrative and not restrictive purposes, and alternative embodiments will become apparent to readers of this patent. Accordingly, the present invention is not limited to the embodiments described above or depicted in the drawings, and various embodiments and modifications may be made without departing from the scope of the claims below.

That which is claimed is:

1. An adjustable friction slider assembly comprising:
a rail member; and
a carriage assembly moveably coupled to the rail member, the carriage assembly comprising:
a bracket member; and
a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member,
wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

2. The adjustable friction slider assembly of claim **1**, further comprising a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

3. The adjustable friction slider assembly of claim **2**, wherein the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

4. The adjustable friction slider assembly of claim **1**, wherein the friction comprises a static friction that causes the carriage assembly to maintain a position along the rail member.

5. The adjustable friction slider assembly of claim **4**, wherein a moving force that overcomes the static friction is applied to the carriage assembly to move the carriage assembly along the rail member.

6. The adjustable friction slider assembly of claim **1**, wherein the rail member comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

7. The adjustable friction slider assembly of claim **1**, wherein the carriage assembly further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

8. A passenger seat comprising an adjustable friction slider assembly comprising:
a rail member coupled to the passenger seat; and
a carriage assembly moveably coupled to the rail member, the carriage assembly comprising:
a bracket member; and
a plurality of roller elements moveably coupled to the rail member and coupled to the bracket member using a plurality of attachment members, the plurality of roller elements comprising at least one adjustable roller element coupled to the bracket member using a moveable attachment member,
wherein moving the moveable attachment member adjusts a friction between the plurality of roller elements and the rail member.

9. The passenger seat of claim **8**, further comprising a moveable sub-assembly coupled to the bracket member, wherein the friction is adjusted based on the moveable sub-assembly.

10. The passenger seat of claim **9**, wherein the moveable sub-assembly comprises a headrest, a video monitor, a tray table, or a portable electronic device holder.

11. The passenger seat of claim **8**, wherein the friction comprises a static friction that causes the carriage assembly to maintain a position along the rail member.

12. The passenger seat of claim **11**, wherein a moving force that overcomes the static friction is applied to the carriage assembly to move the carriage assembly along the rail member.

13. The passenger seat of claim **8**, wherein the rail member comprises a longitudinal axis, and the at least one adjustable roller element is moveable in a direction substantially perpendicular to the longitudinal axis.

14. The passenger seat of claim **8**, wherein the carriage assembly further comprises a friction adjustment member coupled to the moveable attachment member and moving the friction adjustment member adjusts the friction between the plurality of roller elements and the rail member.

15. A method for adjusting a friction of an adjustable friction slider assembly comprising:
coupling a carriage assembly to a rail member, the carriage assembly comprising a plurality of roller elements, the plurality of roller elements comprising at least one adjustable roller element; and
moving the at least one adjustable roller element relative to the rail member to adjust the friction between the plurality of roller elements and the rail member.

16. The method of claim **15**, wherein the friction is adjusted based on a moveable sub-assembly coupled to the carriage assembly.

17. The method of claim **15**, wherein moving the at least one adjustable roller element comprises moving a moveable attachment member, and wherein the moveable attachment member couples the at least one adjustable roller element to the carriage assembly.

18. The method of claim **15**, wherein moving the at least one adjustable roller element relative to the rail member comprises moving the at least one adjustable roller element in a direction substantially perpendicular to a longitudinal axis of the rail member.

19. The method of claim 15, further comprising applying a moving force to the carriage assembly that overcomes a static friction between the carriage assembly and the rail member to move the carriage assembly along the rail member.

20. The method of claim 19, further comprising:

removing the moving force from the carriage assembly; and

maintaining the carriage assembly at a location along the rail member where the moving force is removed due to the static friction between the carriage assembly and the rail member.

* * * * *